#13 9/18/02
81

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re application of:

TAGUCHI ET AL

Application No.:	09/642,765	Art Unit:	1725
Filed:	August 22, 2000	Examiner:	C. Cooke
For:	LEAD-FREE SOLDER PASTE FOR REFLOW SOLDERING		

RESPONSE

Assistant Commissioner for Patents
Washington, D.C. 20231

Dear Sir:

In response to the Official Action mailed on May 10, 2002, the Applicants petition for a one-month extension of time, extending the period for response to and including September 10, 2002, submit the requisite fee therefor, and request reconsideration of the rejections of the claims in view of the following remarks.

Page 2 of the Official Action indicated that in the event that claim 4 is found allowable, dependent claim 5 will be objected to as being a substantial duplicate thereof. This provisional objection to claim 5 is respectfully traversed. Two

claims cannot be substantial duplicates of each other if one claim can read on a composition that the other claim cannot. That situation clearly applies to claims 4 and 5. Claim 5 only reads on a composition that includes two different Sn-Ag-Cu alloy powders. Claim 4, on the other hand, contains no requirement whatsoever concerning the presence of an Sn-Ag-Cu alloy powder, so claim 4 could read on a solder paste which does not contain an Sn-Ag-Cu alloy powder. Thus, as claim 4 and 5 do not necessarily read on the same composition, they are by definition not duplicates of one another, and the provisional objection to claim 5 is erroneous.

The claims received a number of different rejections based on the prior art. These rejections are discussed below as Art Rejections 1 - 5.

Art Rejection 1

On page 2 of the Official Action, claims 1 - 2 and 17 were rejected under 35 USC 103(a) as unpatentable over Paruchuri et al (US Patent No. 5,928,404, referred to below as Paruchuri). This rejection is respectfully traversed.

Claim 1 describes a lead-free solder paste including a plurality of metal powders having a composition when melted with less than 3 mass % Cu. Paruchuri does not disclose or suggest such a composition.

Paruchuri discloses a lead-free solder paste including a primary solder powder and an additive powder component.

Paruchuri states in column 3, line 64 that Cu represents 3 - 10% of the total metal weight of its solder paste, and in the Examples of Paruchuri, all of the pastes have a Cu content of 5.5 wt % or above. There is no contemplation in Paruchuri of lowering the Cu content to below 3%, as set forth in claim 1.

The Official Action acknowledges that Paruchuri does not teach using less than 3% Cu as recited in claim 1, but the Official Action appears to assume that it would have been obvious to have used less than 3% copper because "the prior art range is so close that one skilled in the art would have expected it to have the same properties."

It is respectfully submitted that whether two substances have the same properties is not a test for obviousness. The correct test is whether the reference being relied upon by the Official Action would motivate a person skilled in the art to modify the reference so as to result in a claimed arrangement, and the cited reference fails to do so. Paruchuri specifically states in column 3, line 64 that including 3 - 10 weight % of Cu provides a solder which has improved fatigue and creep resistance, so it can be assumed that adding a smaller amount of Cu will not produce the desired effects sought by Paruchuri. At the least, Paruchuri did not consider that less than 3% Cu would produce the desired effects, so a person skilled in the art would have no reason to contradict the teachings of Paruchuri and include a smaller amount of Cu.

The Official Action relies on *Titanium Metals Corp. v. Banner*, 227 USPQ 773 (Fed. Cir., 1985) in asserting that it would

be obvious to modify Paruchuri from the range that Paruchuri teaches for copper, but reliance on this case is inappropriate. In *Titanium Metals*, the Federal Circuit found that an alloy composition containing .3%Mo-.8%Ni-Ti was obvious when it fell between two data points (.25%Mo-.75%Ni-Ti and .31%Mo-.94%Ni-Ti) disclosed in a reference, with a clear implication in the reference that values for Mo and Ni between these data points (i.e., values for Mo between .25 and .31, and values for Ni between .75 and .94) were possible, and with no description in the reference of limits on the values for Mo and Ni. Thus, the claimed composition in *Titanium Metals* had values for Mo and Ni falling squarely within the ranges for those elements implied by the reference. In the present case, however, the claimed range falls outside the range defined by the cited reference. In order for the claimed range to be obvious, there must be some clear motivation for a person skilled in the art to modify the range defined by the reference, but the Official Action fails to show any such motivation.

Therefore, as Paruchuri does not disclose or suggest the composition set forth in claim 1, and as the Official Action does not show any motivation to modify Paruchuri to extend the copper content of Paruchuri outside the range taught by Paruchuri, the reference cannot render claim 1 obvious. Claim 1 and claims 2 and 17 which depend from claim 1 are therefore allowable.

Dependent claim 17 further patentably distinguishes the present invention from Paruchuri. Claim 17 describes a soldering

method including melting the plurality of metal powders in the solder paste of claim 1. Paruchuri does not disclose or suggest such a method. As described in column 3, line 34 of Paruchuri, the additive powder used in that reference does not melt except for a certain amount of dissolution during the soldering process. Again, column 5, lines 53 - 59 state that in the examples, soldering is carried out in an oven with a thermal profile such that a primary powder 2 melts but the additive powder 4 does not melt (except for a certain amount of dissolution). This statement applies not to a single composition but to all 20 compositions shown in Table 1. The claims of Paruchuri include cases in which the additive powder is bismuth, lead, or tin, and in each case, the claim specifies that the additive powder does not melt, further emphasizing that Paruchuri does not contemplate melting of the additive powder 4. On the contrary, in Paruchuri it is essential for the additive powder not to melt in order for the resulting solder joint to exhibit the desired effects of a large stand-off height and fatigue resistance (referred to in column 3, lines 36 - 40 of Paruchuri), because if the additive powder melts, it will not function as a reinforcing material. Thus, Paruchuri is unequivocal that in soldering using its soldering composition, the additive powder is not to be melted. Nowhere does Paruchuri include melting a plurality of metal powders in a solder paste, so it fails to teach or suggest all the features of claim 17 and cannot render this claim obvious.

Art Rejection 2

On page 3 of the Official Action, claims 1 - 18 were rejected under 35 USC 103(a) as unpatentable over Paruchuri in view of Sakai et al (U.S. Patent No. 6,077,477, referred to below as Sakai). This rejection is respectfully traversed because there is no motivation in the references to combine them in the manner proposed by the Official Action.

As discussed above, Paruchuri discloses a lead-free solder paste in which Cu represents 3 - 10% of the total metal weight of its solder paste. There is no suggestion in Paruchuri of decreasing the Cu content below 3%.

Sakai discloses a solder alloy which in one embodiment contains 92 - 97% Sn, 3 - 6% Ag, and 0.1 - 2% Cu.

The Official Action concludes that it would have been obvious to have modified Paruchuri to employ a Cu content of less than 3% as taught by Sakai because "Sakai et al. teaches a solder joint having this small amount of copper has enhanced mechanical properties."

This conclusion is erroneous. A person skilled in the art would find no motivation from Sakai to modify Paruchuri as proposed by the Official Action because there is no indication that doing so would in any way further the objectives of Paruchuri.

Paruchuri repeatedly states that its object is to increase the fatigue life of a solder joint, particularly in automotive applications. For examples, column 3, lines 1 - 4 of Paruchuri state that the invention seeks to enhance solder interconnect

fatigue life. To this end, Paruchuri states in column 3, lines 60 - 66 that a solder composition having 3 - 10% of copper as an additive power provides a solder which has improved fatigue and creep resistance.

Sakai teaches a lead-free solder containing less than 3 weight % of copper, but there is no teaching that copper in any way contributes to fatigue strength. Column 2, line 56 of Sakai does say that the addition of <u>silver</u> improves the thermal fatigue resistance characteristics, but Sakai is silent about copper having any advantageous effect on fatigue strength.

There is also no teaching in Sakai that its solder alloy is superior or even comparable in fatigue strength to that of the solder composition of Paruchuri, and so no reason for a person skilled in the art to think that the solder composition of Sakai would be in any way advantageous to the composition of Paruchuri.

Furthermore, Paruchuri relates to a solder composition having multiple powders in which the primary powder melts while the additive powder does not (see lines 1 - 3 of the Abstract of Paruchuri), so a joint formed by the solder composition of Paruchuri is not an alloy of all the metals which it contains. In contrast, Sakai relates to a simple single-powder solder in which all metal components are part of a single alloy. There is no teaching in either reference that a solder joint produced by a multiple-powder composition (like the solder joint of Paruchuri) in which not all the metals are alloyed to each other at the completion of soldering has the same metallurgical characteristics as a solder joint formed from a single alloy

powder (like a solder joint formed from the alloy of Sakai). Aside from the lack of teachings, there is no scientific reason to think that a plurality of metals in a joint which are not alloyed to each other will behave in the same way as a single alloy of those same metals. Therefore, even if Sakai did describe its solder paste as having merits not provided by the solder paste of Paruchuri, a person skilled in the art would find no reason in Sakai to modify Paruchuri because there is no basis in the references for thinking that the merits of a single-powder paste would be effective in the multiple-powder solder composition of Paruchuri, in which the powders do not end up forming a single alloy, thereby making it fundamentally different in nature from the solder composition of Sakai.

Thus, as there is no motivation in the references to combine them as proposed in the Official Action, the Official Action fails to set forth a prima facie case of obviousness, and the rejection of claims 1 - 18 is improper. Claims 1 - 18 are therefore allowable.

Claim 3 further patentably distinguishes the present invention from the cited references. Claim 3 describes a lead-free solder paste including two different Sn alloy powders. Neither of the cited references discloses or suggests such a composition. Paruchuri discloses a solder composition including a primary powder in the form of an Sn alloy and an additive powder in the form of an elemental metal, such as elemental Ag, Cu, Ni, or Bi. There is no contemplation in Paruchuri of a

solder paste containing more than one Sn alloy powder. This is clear from Table 1 in column 5 of Paruchuri, in which all of the Examples employ an elemental metal powder as the additive powder.

Page 4 of the Official Action states that Paruchuri envisions the mixing of multiple powders of an Sn alloy, but Paruchuri provides no support for this assertion. The Official Action quotes column 5, lines 8 - 12 of Paruchuri, which states,

> "The solder compositions that were found to include the preferred properties include solders having a primary powder of tin-silver alloy or tin-lead-silver alloy, and an additive powder of tin, lead, silver, nickel, copper, or bismuth, or combinations thereof."

The Official Action concludes that "the mixing of a tin-silver alloy with a tin-silver-copper alloy or a tin-copper alloy are envisioned by the teachings of Paruchuri et al". There is no basis, either grammatical or scientific, for this conclusion. Paruchuri does not appear to have any difficulty in properly using the word "alloy" when it means to refer to an alloy, and there is no instance in which Paruchuri uses "combination" when referring to an alloy. When Paruchuri uses "combinations thereof", it is clear that it means that it is possible to use more than one additive powder, i.e., a physical mixture of the additive powders. A "combination of powders", i.e., a mixture, is not the same thing as an alloy of powders, and if one looks at the 20 examples of compositions in Table 1 of Paruchuri, one cannot find a single instance to support the assertion in the Official Action that Paruchuri suggests the use of more than one alloy powder.

As discussed above, Sakai discloses a solder alloy which in

one embodiment contains 92 - 97% Sn, 3 - 6%Ag, and 0.1 - 2% Cu. There is no disclosure or suggestion in Sakai of a solder paste including a plurality of powders of any type.

Thus, as the cited references fail to disclose or suggest a lead-free solder paste including two different Sn alloy powders, they do not teach all the features of claim 3 and so cannot render it obvious. Claim 3 and claims 4 - 16 which depend from it are therefore allowable.

Claims 9 and 10 further patentably distinguish the present invention from the cited references. Claim 9 describes a soldering method including performing reflow soldering at a temperature of at most 250°C, while claim 10 describes a soldering method including performing reflow soldering at a reflow temperature of at most 240°C. Neither of the cited references discloses or suggests such a method. As a basis for rejecting these claims, the Official Action states that "The composition, as taught by Sakai et al., has a melting point of 237 - 245°C". The Official Action is correct that Sakai teaches a solder composition with a melting point of 237 - 245°C, and that is exactly why it would not be obvious from the cited references to perform reflow soldering at a reflow temperature of at most 250°C or at most 240°C as in claims 9 and 10. As explained on page 2, lines 21 - 24 of the present application, reflow soldering with solder paste is usually carried out at a reflow temperature which is 40 - 50°C higher than the melting point of the solder alloy in the solder paste in order to

optimize spreading and minimize soldering defects. Therefore, reflow soldering with a solder alloy having a melting point of 237 - 245°C, as in Sakai, would typically be carried out at a reflow temperature of 287 - 297°C, which is nowhere near the range specified in claims 9 and 10. Thus, the cited references do not teach or suggest performing reflow soldering in the ranges recited in claims 9 and 10, so the references cannot be combined to result in methods having all the features of these claims and cannot render them obvious.

Independent claim 18 further patentably distinguishes the present invention from the cited references. Claim 18 describes a soldering method including heating a solder paste including a plurality of different types of metal powder to melt the metal powders. As described in column 3, line 34 of Paruchuri, the additive powder used in that reference does not melt except for a certain amount of dissolution during the soldering process, whereby the unmelted particles can provide a reinforcing effect (column 6, line 39). Thus, Paruchuri teaches away from a method in which a plurality of different types of metal powder are melted during soldering. Sakai does not disclose anything about a solder paste having a plurality of powders, so it adds nothing to the disclosure of Paruchuri.

The Examiner is correct that Paruchuri teaching the melting of a powder, but it certainly does not teach the melting of a plurality of powders as set forth in claim 18. In fact, if Paruchuri were to melt a plurality of powders, it would not be

satisfying the above-mentioned objective of having unmelted particles which provide a reinforcing effect.

Thus, as Paruchuri and Sakai do not teach or suggest heating a solder paste including a plurality of different types of metal powder to melt the metal powders, they do not contain teachings that could be combined to result in a method having all the steps recited in claim 18 and so cannot render this claim obvious. Claim 18 is therefore allowable.

Art Rejection 3

On page 5 of the Official Action, claims 1 - 18 were rejected under 35 USC 103(a) as unpatentable over Paruchuri in view of Hitch et al (WO 97/09455, referred to below as Hitch). This rejection is respectfully traversed as being erroneous because there is no motivation in the references to combine them in the manner proposed in the Official Action.

As discussed above, Paruchuri discloses a lead-free solder paste in which Cu represents 3 - 10% of the total metal weight of its solder paste.

Hitch discloses a soldering composition in which copper is added to an Sn-Ag alloy to produce a nearly eutectic Sn-Ag-Cu ternary alloy, to which additional elements may be added. According to page 2, line 2 of Hitch, a preferred composition of the ternary alloy is 95.8Sn - 3.5Ag-0.67Cu.

The Official Action states that it would have been obvious to modify the solder paste of Paruchuri to include an amount of copper less than 3% because Hitch teaches that a solder joint of

this composition has "superior properties". However, Hitch defines properties (such as solderability, fatigue, corrosion) only in relative terms, and there is no teaching that these properties are any better than or even as good as those of the solder paste taught by Paruchuri. Furthermore, Hitch never gives any reason why the copper content is within a specific range, and Hitch does not relate these "superior properties" to the level of copper, so a person skilled in the art would find no motivation from Hitch to modify the copper content of Paruchuri.

At the same time, were a person skilled in the art to modify Paruchuri as proposed by the Official Action, he would have to be ignoring the explicit teaching in column 3, line 64 of Paruchuri that including 3 - 10 weight % of Cu provides a solder which has improved fatigue and creep resistance, with no evidence that the alloys of Hitch are in any way superior to those of Paruchuri. In other words, a person skilled in the art would need to arbitrarily ignore the teachings of the primary reference. No motivation can be found in the references for doing so.

Moreover, Paruchuri and Hitch relate to fundamentally different types of solder compositions. As discussed above with respect to Art Rejection 2, Paruchuri relates to a solder composition having multiple powders in which the primary powder melts while the additive powder does not melt. Hitch, on the other hand, relates to a simple single-powder solder. There is no teaching in either reference that a solder joint produced by a multiple-powder composition (like the solder joint of Paruchuri) has the same metallurgical characteristics as a solder joint

formed from a single alloy powder (like a solder joint formed from the alloys disclosed in Hitch) and no reason to think that the metallurgical considerations described by Sakai would have any relevance to the multiple-powder solder composition of Paruchuri. A person skilled in the art would find no reason to even consult Hitch in considering how to improve the solder composition of Paruchuri and accordingly no motivation to modify Paruchuri based on Hitch.

Thus, as Paruchuri and Sakai provide no motivation to combine them in the manner proposed in the Official Action, the grounds of rejection of claims 1 - 18 fail to set forth a prima facie of obviousness and are improper. Claims 1 - 18 are therefore allowable.

Independent claim 3 is allowable for the reasons given above, and further because the cited references fail to disclose or suggest all the features of this claim. As discussed above, claim 3 describes a lead-free solder paste including two different Sn alloy powders. Neither of the cited references discloses or suggests such a composition. As stated above, Paruchuri discloses a solder composition including a primary powder in the form of an Sn alloy and an additive powder in the form of an elemental metal, such as elemental Ag, Cu, Ni, or Bi, and there is no contemplation in Paruchuri of a solder paste containing more than one Sn alloy powder. Hitch was relied upon as teaching a solder composition having a Cu content of less than 3%. There is no teaching or suggestion in Hitch concerning a

solder paste containing multiple powders.

Thus, since neither Paruchuri not Hitch discloses or suggests a lead-free solder paste including two different Sn alloy powders, combining the references as proposed by the Official Action would not result in a composition having all the features of claim 3, so the combination of references cannot render claim 3 obvious. Claim 3 and claims 4 - 16 which depend from it are therefore allowable.

Claims 9 and 10 yet further patentably distinguish the present invention from the cited references. As discussed above, claim 9 describes a soldering method including performing reflow soldering at a temperature of at most 250°C, while claim 10 describes a soldering method including performing reflow soldering at a reflow temperature of at most 240°C. As a basis for rejecting these claims, the Official Action refers to three examples of Hitch, which have melting points of 213 - 218°, 214 - 215°C, and 214 - 216°C. Since reflow soldering with solder paste is usually carried out at a reflow temperature which is 40 - 50°C higher than the melting point of the solder alloy in the solder paste, reflow soldering with the examples of the solder alloys of Hitch pointed out by the Examiner would typically be carried out at a temperature of 254 - 264°C or above. Thus, combining the references in the manner proposed by the Official Action would not result in a method in which reflow soldering is performed in the temperature ranges recited in claims 9 or 10, so the cited references cannot render these claims obvious.

Dependent claim 17 and independent claim 18 also further patentably distinguish the present invention from the references because the references fail to disclose or suggest all the features of these claims. Claims 17 and 18 each describe a soldering method including heating a solder paste including a plurality of different types of metal powder to melt the metal powders. In Paruchuri, the additive powder does not melt except for a certain amount of dissolution during the soldering process, whereby the unmelted particles can provide a reinforcing effect. Hitch was relied upon for its teaching of a solder composition having a Cu content of less than 3%, and it teaches nothing about the use of multiple metal powders in a solder paste. Therefore, combining Paruchuri with Hitch as proposed by the Official Action would not result in a method including heating a solder paste including a plurality of different types of metal powder to melt the metal powders and so would not result in a method having all the steps set forth in claims 17 and 18. Accordingly, the cited references cannot render claims 17 and 18 obvious, so these claims are allowable.

Art Rejections 4 and 5

On page 7 of the Official Action, claims 3 - 12, 14 - 16, and 18 were rejected under 35 USC 103(a) as unpatentable over Kazem-Goudarzi et al (U.S. Patent No. 5,540,379, referred to below as Kazem-Goudarzi) in view of Seelig et al (U.S. Patent No. 5,352,407, referred to below as Seelig) and further in view of Sakai. On page 8 of the Official Action, claims 3 - 12, 14 - 16,

and 18 were rejected under 35 USC 103(a) as unpatentable over Kazem-Goudarzi in view of Seelig and further in view of Hitch. These rejections are respectfully traversed because there is no motivation in the references to combine them in the manner proposed in the Official Action. Since both rejections have the same basic premise and rely on two of the same references, they will be discussed at the same time.

Kazem-Goudarzi, the primary reference in both rejections, discloses a soldering process employing two different types of solder alloys. A solder paste containing a low temperature alloy and a high temperature alloy is applied to a solderable surface of a printed circuit board. The paste is then heated to a temperature to melt the low temperature alloy but not the high temperature alloy so as to form a solid solder mass having a flat textured surface. A surface mounted part is then placed on a desired location in contact with the reflowed solder composition, and then reflow is carried out a second time at a higher temperature than before in order to remelt the low temperature alloy and then melt the high temperature alloy. It is important for the alloys to have unique melting ranges so that one alloy can be melted without melting the other alloy during the first reflow. Kazem-Goudarzi gives only two specific examples of such solder alloys (column 4, lines 3 - 10), which are a Sn-Pb-Ag alloy having a melting point of 179 - 181 °C and a Sn-Pb-Bi alloy having a melting range of 144 - 163 °C. Thus, in that example, the melting ranges of the two alloys come no closer than 16°C.

Seelig, a secondary reference in both rejections, was relied upon as teaching the advantages of a lead-free bismuth-free solder alloy, but what Seelig proposes as an alternative to a solder containing lead or bismuth is one containing antimony as an essential element.

Sakai, a secondary reference in Art Rejection 4, was relied upon as teaching a Sn-Ag-Cu alloy containing 92-97% Sn, 3 - 6% Ag, and 0.1 - 2% Cu.

Hitch, a secondary reference in Art Rejection 5, was relied upon as teaching solder alloys having compositions of 93.8 - 96.4% Sn, 3.1 - 3.5% Ag, and 0.5 - 2.7% Cu.

In Art Rejection 4, the Official Action asserts that "it would have been obvious to modify the dual alloy paste of Kazem-Goudarzi et al. by using alloys of tin with copper and/or silver to arrive at a final composition such as that taught by Sakai et al. because Seelig et al. teaches removing the lead and bismuth and using Sn-Ag-Cu instead, while Sakai et al. teaches that the specific Sn-Ag-Cu compositions exhibit superior properties."

In Art Rejection 5, the Official Action asserts that "it would have been obvious to modify the dual alloy paste of Kazem-Goudarzi et al. by using alloys of tin with copper and/or silver to arrive at a final composition such as that taught by Hitch et al. because Seelig et al. teaches removing the lead and bismuth and using Sn-Ag-Cu instead, while Hitch et al. teaches that the specific Sn-Ag-Cu compositions exhibit superior properties."

A first error in both rejections is that the rejections

erroneously rely on Seelig as proposing a Sn-Ag-Cu alloy as an alternative to prior art solder alloys containing lead and bismuth, such as the lead and bismuth-containing alloys disclosed in the examples of Kazem-Goudarzi. This characterization of Seelig by the Official Action is incorrect. Antimony is an essential element in the solder composition of Seelig, and so there is nothing in Seelig to motivate a person skilled in the art to employ a Sn-Ag-Cu alloy in the soldering process of Kazem-Goudarzi, as proposed by the Official Action.

A second error in both rejections is that neither Sakai nor Hitch teaches Sn-Ag-Cu alloys that would meet the requirements of a solder paste of Kazem-Goudarzi. As mentioned above, it is important for the alloys of Kazem-Goudarzi to have unique melting ranges so that one alloy can be melted without melting the other one. There is no teaching in Sakai of Sn-Ag-Cu alloys that have melting points sufficiently different from each other to permit them to be used in Kazem-Goudarzi.

The same applies to Hitch. The ternary Sn-Ag-Cu alloys taught by Hitch have melting ranges so close to each other as to make it impossible to melt them separately from each other. For example, the Sn-Ag-Cu alloys of Examples 1 - 3 of Hitch (which the Official Action specifically points out at the top of page 9) have melting ranges of 213 - 218°C, 214 - 215°C, and 214 - 216°C. No person skilled in the art would be motivated to employ such alloys in Kazem-Goudarzi because it would be impossible to melt one alloy without simultaneously melting the other.

Therefore, as Seelig does not teach anything about employing an Sn-Ag-Cu alloy, a person skilled in the art would receive no motivation from Seelig to employ such an alloy in Kazem-Goudarzi. Furthermore, since neither Sakai nor Hitches teaches Sn-Ag-Cu alloys suitable for the purposes of Kazem-Goudarzi, a person skilled in the art would receive no motivation from these references to employ the alloys disclosed in Sakai or Hitch. Accordingly, as the references provide no motivation to combine them in the manner proposed in the Official Action, the Official Action fail to set forth a prima facie case of obviousness with respect to Art Rejections 4 and 5, so these rejections are improper. Claims 3 - 12, 14 - 16, and 18 are therefore allowable.

Claims 9 and 10 further patentably distinguish the present invention from the cited references for the same reasons given with respect to Art Rejections 2 and 3. Claim 9 describes a soldering method including performing reflow soldering at a temperature of at most 250°C, while claim 10 describes a soldering method including performing reflow soldering at a reflow temperature of at most 240°C. In Art Rejection 4, the Official Action suggests that it would be obvious to perform reflow soldering in the range claimed in claim 9 or 10 because Sakai teaches a solder having a melting point of 237 - 245°C, and in Art Rejection 5, the Official Action suggests that it would be obvious to perform reflow soldering in the range claimed in claim 9 or 10 because Hitch teaches solders having melting points of

213 - 218°, 214 - 215°C, and 214 - 216°C. Since reflow soldering with solder paste is usually carried out at a reflow temperature which is 40 - 50°C higher than the melting point of the solder alloy in the solder paste, reflow soldering with the solder disclosed in Sakai would typically be carried out at a reflow temperature of 287 - 297°C, while reflow soldering with the examples of the solder alloys of Hitch pointed out by the Examiner would typically be carried out at a temperature of 254 - 264°C or above. Thus, regardless of whether the Official Action proposes to combine Kazem-Goudarzi and Seelig with Sakai or with Hitch, the resulting combination of references would not include performing reflow soldering within the ranges defined by claims 9 or 10 and so would not render these claims obvious. Claims 9 and 10 are thus allowable.

In light of the foregoing remarks, it is believed that the present application is in condition for allowance, and favorable consideration is respectfully requested.

Respectfully submitted,

Michael Tobias

Michael Tobias
Registration Number 32,948

#40
1717 K Street, N.W., Suite 613
Washington, D.C. 20036
Telephone: (301) 587-6541
Facsimile: (301) 587-6623
Date: Sep 10, 2002